Nobel Prize 2018 in physics and its impact on Light Robotics

Glückstad, Jesper

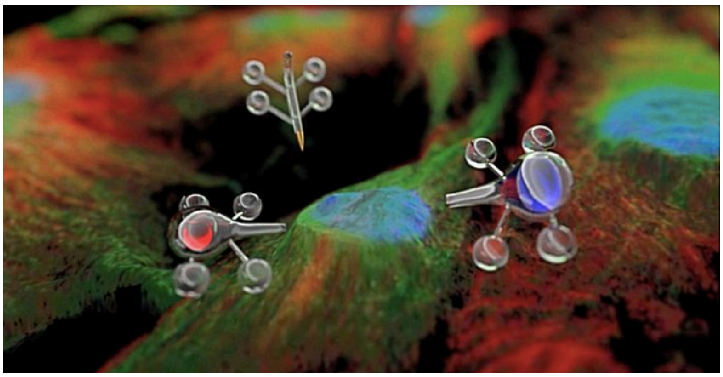
Publication date:
2018

Document Version
Publisher's PDF, also known as Version of record

Nobel Prize 2018 in physics and its impact on Light Robotics

Jesper Glückstad
Technical University of Denmark
Ørsted Plads 343, DK-2800 Kgs. Lyngby, Denmark
Jesper.gluckstad@fotonik.dtu.dk
www.PPO.dk www.OptoRobotix.com www.GPCphotonics.com

With the recent Nobel Prize in Physics partly granted to the invention and applications of optical tweezers generating tremendous impact in biophotonics over the last few decades, we start to see a confluence of developments that is now ripe for the emergence of a new area that can contribute to biophotonics at the cellular level – *Light Robotics* – which combines advances in microscopic 3D-printing, 3D light sculpting and advanced light-matter interaction and actuation [1-14]. Last year we published a comprehensive Elsevier book volume [15] covering the fundamental aspects needed for Light Robotics including optical trapping systems, microfabrication and microassembly as well as underlying theoretical principles and experimental illustrations for optimizing optical forces and torques. The Light Robotics book is presenting various novel functionalities that are enabled by these 3D designed light-driven micro-robots (or micro-drones) in addition to various nano-biophotonics applications demonstrating the unique use of biophysical tools based on light robotic concepts. We have endeavored to make this new discipline accessible to a broad audience from advanced undergraduates and graduate students to practioners and researchers not only in nano-biophotonics and micro- and nanotechnology but also to other areas in optics, mechanical engineering, control and instrumentation engineering and related fields.



Light Robotic tools in operation inside a microbiologic environment

1) Glückstad, J., "Sorting particles with light", Nature Materials 3, 9 (2004).
2) Rodrigo, P. , Gammelgaard, L., Bøggild, P., P.-Nielsen, I., Glückstad, J., Opt. Express 13, 6899 (2005)
3) Glückstad, J. & Palima, D., "Generalized Phase Contrast", Springer Series in Optical Sciences, 315 pages (2009).
4) Papagiakoumou, E., Anselmi, F., Begue, A., Sars, V., Glückstad, J., Isacoff, E., Emiliani, V., Nature Methods 7, 848 (2010).
5) Tauro, S., Bañas, A., Palima, D., Glückstad, J., Opt. Express 18, 18217 (2010)
6) Glückstad, J., "Sculpting the object", Nature Photonics 5, 7 (2011)
7) Palima, D., Bañas, A., Vizsnyiczai, G., Kelemen, L., Ormos, P., Glückstad, J.,"Wave-guided Optical Waveguides", Opt. Express 20, 2004 (2012).
8) Palima, D., & Glückstad, J.,"Gearing up for optical micro-robotics: synthetic microstructures actuated by optical trapping and optical manipulation", Lasers & Phot. Reviews 17, 478 (2013).
9) Wu, C., Palima, D, Novitsky, A; Ding, W; Gao, D; Shukovsky, S; and Glückstad, J.,"Engineering light-matter interaction for emerging optical manipulation applications", Nanophotonics 3, 181 (2014).
10) Villangca, M., Bañas, A., Palima, D., and Glückstad, J.,"Dynamic diffraction-limited light-coupling of 3D-maneuvered wave-guided optical waveguides," Opt. Express 22, 17880 (2014).
11) Villangca, M., Bañas, A., Palima, D., Glückstad, J., "Generalized phase contrast-enhanced diffractive coupling to light-driven microtools" Opt. Eng. 54, 111308 (2015).
12) Villangca, M., Casey, D., Glückstad, J.,"Optically-controlled platforms for single- and sub-cellular transfection and surgery," Biophysical Reviews 7, 379 (2015).
13) Villangca, M., Palima, D., Bañas, A., Glückstad, J., "Light-driven micro-tool equipped with a syringe function," Light: Science & Applications, Nature Publ. Group, 5 (9) e16148 (2016).
14) Bañas and J. Glückstad, "Holo-GPC: Holographic Generalized Phase Contract," Opt. Comm., 392, 190-195 (2017).
15) Glückstad, J. & Palima, D., "Light Robotics: structure-mediated nanobiophotonics", Elsevier Science, 482 pp (2017).